**What does a Measuring Device have to do with math?**

**Video:** <https://youtu.be/ZV5XZuie0eY>

**Lesson Plan**

**Teacher Note:** Please preview the entire video and pre-work the solutions in order to anticipate students’ needs, misconceptions and materials unique to your classroom.

**Common Core Mathematical Content Standards**

* 6.NS.B Compute fluently with multi-digit numbers
* 6.NS.2 Fluently divide multi digit numbers using the standard algorithm.

**Common Core Mathematical Practice Standards**

1. Make sense of problems and persevere in solving them.

3. Construct viable arguments and critique the reasoning of others

6. Attend to precision

**Company Information**

Ariens Company is a Brillion, Wisconsin-based equipment company which manufactures snow blowers, lawn mowers, and other “chore products” for commercial and high-end consumer markets. This four-generation company has a long history and touts itself as being the “mower of the White House lawn” and “official snow blower of Lambeau Field”.

**Summary**

How is math used to help a company make purchasing decisions? In this video we watch as a team works together to decide if purchasing a new mobile measuring device for the factory floor makes sense…and that decision is based on mathematical calculations!

**Pre-Activity Discussion:**

* Vocabulary
  + Formula
  + Total Cost
  + Total Revenue
  + Recuperate
  + Cost benefit analysis formula
    - Total Cost /Total Revenue = Length of time to recuperate costs (return on investment)
    - The standard length of time for most companies is 2 to 5 years depending on the size of the purchase.
  + Current state
  + Future state
  + Cost of Quality
    - Total cost of Quality = Cost of poor quality + cost of good quality

**Differentiation:**

* The questions on the student handout are scaffolded to meet the needs of students who may need extra support.
* Eliminating some of the added questions, and just posing the questions from the video would be a possible differentiation strategy for students who do not need the extra support.
* Students may also benefit by working with others as part of a partner/group investigation.

**Part 1: (0:00 – 2:00)**

BREAK 1

* Problem posed: *How much does it cost the company per year to do the measuring using the current process?*
* Information given
  + Cost benefit analysis formula
    - Total Cost /Total Revenue = Length of time to recuperate costs
  + 4 hours each week
  + $26 per hour
* Discuss with students how the data may have been collected to determine that the measurement time in total was 4 hours per week.
* Have students use part one of student handout to document their calculations and thinking
* Before showing Part 2 have students share their solution methods

**Part 2: (2:04 – 2:40)**

BREAK 2

* Discuss the solution from Part 1 and any calculation errors or misconceptions
* Problem posed: *How much will it cost the company each year to do the measuring using the mobile device?*
* Information given
  + 2 hours each week
  + $26 per hour
* Students are asked to answer the question on the student handout.
* Before showing Part 3 have students share their answers and problems solving methods.

**Part 3: (2:42 –** **3:16)**

BREAK 3

* Discuss the solution from Part 2 and any calculation errors or misconceptions
* Problem posed: *Should they purchase the new mobile measuring device?*
* Information given:
  + The cost to purchase the new device is $2100
  + Cost benefit analysis formula
    - Total Cost /Total Revenue = Length of time to recuperate costs (return on investment)
    - The standard length of time for most companies is 2 – 5 years depending on the size of the purchase
* Before showing Part 4 have students share their answers and problems solving methods.

**Part 4: (3:19 – 5:06)**

* Discuss the solution from Part 3 and any calculation errors or misconceptions

**Extension:**

* Investigate other factors that could be considered when a company calculates “return on investment” besides a decrease in cost due to worker efficiency.
* Explain how does the cost of college and the ability to earn a higher salary with more education fit with “return on investment” thinking?
* Are there times when companies should not make decisions using a cost-benefit analysis? Explain.
* Elaborate on the phrase “Not all costs are bad costs” and “good quality versus bad quality”. Can you think of other examples to illustrate these ideas?

**Student Handout - *What does a Measuring Device have to do with math?***  Name(s):

**Pre-Video Discussion:**  *Notes on important background information and vocabulary.*

**Break 1:** **Problem:** *How much does it cost the company per year to do the measuring using the current process?*

1. List the information given to you in the video.

2. Use the information that was given to you to calculate a solution to the problem

**Break 2: Problem:** *How much will it cost the company each year to do the measuring using the mobile device?*

3. List the information given to you in the video.

4. Use the information that was given to you to calculate a solution to the problem.

**Break 3: Problem:** *Should they purchase the new mobile measuring device?*

5. Write the cost benefit analysis formula.

6. Calculate the solution to the problem using the formula in #5.

7. Should the device be purchased? Why or why not?

8. Stretch your thinking - 10 years from now, what is the total amount of money that the mobile device will have saved the company?

**Answer Key *What does a Measuring Device have to do with math?***

**Break 1:** **Problem:** *How much does it cost the company per year to do the measuring using the current process?*

1. List the information given to you in the video.

* + **4 hours each week**
  + **$26 per hour**

2. Use the information that was given to you to calculate a solution to the problem

**4 x 26 x 52 = $5408.00**

**Break 2: Problem:** *How much will it cost the company each year to do the measuring using the mobile device?*

3. List the information given to you in the video.

* + **2 hours each week**
  + **$26 per hour**

4. Use the information that was given to you to calculate a solution to the problem.

**2 x 26 x 52 = $2704.00**

**Break 3: Problem:** *Should they purchase the new mobile measuring device?*

5. Write the cost benefit analysis formula.

* + **The cost to purchase the new device is $2100**
  + **Cost benefit analysis formula**
    - **Total Cost /Total Revenue = Length of time to recuperate costs (return on investment)**
    - **The standard length of time for most companies is 2 – 5 years depending on the size of the purchase**

6. Calculate the solution to the problem using the formula in #5.

**2100 / (5408 – 2704) = 0.77 years or 9.24 months**

7. Should the device be purchased? Why or why not?

**Yes, the return on investment time is well under the standard 2-5 years**

Stretch you thinking -